

Retinoid Biochemistry: Retinaldehyde vs Retinol and Plant-Derived Bakuchiol (Engineering Review 2025)

Por Cristiano Ricardo · Publicado em 15/11/2025

Technical dermocosmetic engineering lecture by Prof. Cristiano Ricardo on retinoid biochemistry: retinaldehyde vs retinol and plant-derived bakuchiol (Clinical Dermocosmetology & Nuclear Receptor Signaling), featuring colorful schematic diagrams and clinical data.

Versão online e eventuais atualizações:

<https://professor.cristianoricardo.com/post/retinoid-biochemistry-retinaldehyde-vs-retinol-and-plant-derived-bakuchiol-2025-11-15>

Clinical Dermocosmetology & Nuclear Receptor Signaling · Cosmetic Engineering & Science

Vitamin A metabolites remain the gold standard in cellular turnover and dermal extracellular matrix remodeling.

Engineering Mechanism & Kinetic Flowchart

Retinyl Esters

2 Steps Away

Retinol

Oxidized by ADH

Retinaldehyde

Direct Precursor to Active Acid

Metabolic Bio-Activation Pathways in Keratinocytes

To stimulate retinoic acid receptors (RAR and RXR), topically applied retinyl palmitate must undergo esterase hydrolysis to retinol, alcohol dehydrogenase (ADH) oxidation to retinaldehyde, and final retinaldehyde dehydrogenase (RALDH) oxidation into all-trans retinoic acid. Retinaldehyde is up to 11 times faster converted than pure retinol, exhibiting direct antibacterial action against *C. acnes*.

Matrix Metalloproteinase (MMP) Inhibition

Active retinoids suppress ultraviolet-induced AP-1 transcription factors, halting synthesis of MMP-1 (collagenase), MMP-3 (stromelysin), and MMP-9 (gelatinase), thereby protecting dermal type I collagen scaffolds from enzymatic photodamage.

Bakuchiol as a Functional Genomic Analog

A meroterpene isolated from *Psoralea corylifolia* seeds that displays retinoid-like gene expression profiling (upregulating collagen types I, III, and IV) without triggering retinoid dermatitis, erythema, or phototoxicity.

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